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ABSTRACT

This paper examines how well teachers are integrating computers across their curriculum. A survey was distributed to elementary school teachers who taught kindergarten through fifth grade (six teachers for each grade, except kindergarten which had three). A total of 60 survey questions measured teachers' impressions of their affect, knowledge, level of computer usage in the content areas, instructional preparation, and school settings. Overall, a majority of the teachers surveyed stated they did not like to teach with technology. Primary teachers have a high level of integration with language arts, science, and math; however, they have a low integration level with social studies, health, art and music. Forty-four percent of primary and 50% of upper grade teachers use the computer for drill-and-practice games. Both primary and upper grade teachers state they have the knowledge to be effective technology integrators. A majority of them blame time as the greatest barrier to their successful integration of computers. Implications for pre-service and in-service teachers and present and future research are discussed. (AEF)

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Teacher Attitudes and Effective Computer Integration

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Abstract

Everyday more computers are being put into elementary classrooms. However, putting a computer into a classroom and using it effectively are two entirely different entities. The question I have asked is how well are teachers integrating computers across their curriculum? I surveyed one elementary school in hopes of answering this question and I asked teachers about their perceived levels of computer integration. These results were then compared and contrasted to their actual integration levels as represented by particular questions in the survey instrument. Finally, I have provided some suggestions for effective computer integration across the elementary curriculum.

To enhance the "high tech" world of students, teachers are feeling the pressure to integrate more technology into the curriculum. More schools nationally are being tested on technology, such as The Standards of Learning, given in Virginia's fifth grades. In many cases, the pressure to teach technology has been met with mixed feelings and mixed results.

Formerly teachers who used the overhead projector, VCR and tape recorders were seen as having "high tech" classrooms. Today, some elementary teachers are using not only the television and VCR for instruction, but computers and camcorders as well. Furthermore, some of this group goes well beyond the drill-and-practice games in their computer instruction. Instead, they are utilizing this "high tech" software to extend and enhance their classroom instruction.

Teachers are constantly advised to connect the classroom learning to the outside world. However, if teachers are not using computer technology, they are missing a major portion of their students' environments. Computers are everywhere -- homes, stores, libraries, banks, doctor's offices, and restaurants. Nevertheless, they are absent from the daily school life for many elementary school children.

Northup, Barth, and Kranze (1991) state that 20% of information is retained when in a lecture format, 40% is retained when in a discussion method, but 80% is retained when interactive computers are used in the instruction. This 80% retention rate is accomplished through interactive computer use as opposed to computer drill games. For example, a weather spreadsheet on monthly average temperatures will produce a higher retention rate on averages and graphing with the use of a computer. If the students only hear a lecture on these concepts, the retention rate will be much lower. After all, students remember 80% of what they see, do and

hear, but only 20% of what they hear (Green, 1996). The computers are a medium for which students can take the information heard and develop it into a more visual and active learning process. However, this knowledge of how elementary students can benefit from a highly interactive environment has not been distributed to all elementary teachers.

Having a computer in the classroom and attending an in-service will not guarantee effective classroom use (Barnett and Nichols, 1994). In fact, there remain many teachers reluctant even to turn on the computer. One teacher in my study grumbled, "Why does a fifth grader have to understand data bases, spreadsheets and all the other cute programs available. Our elementary students need to read, write, spell, do math, understand some scientific things (and enjoy them), history, and English. No short cuts please. Computers are easy to learn. Let them do it later through dedicated 'elective' courses, not in elementary school." His/her response is, unfortunately, not atypical.

Furthermore, those who are using computers are not always effectively integrating them throughout all subject domains. I wanted to understand how the cohort of teachers at one particular elementary school perceived their own level of computer expertise and integration into instruction.

Method

Subjects.

I distributed the survey (See Appendix) to one school in the eastern portion of the United States. This elementary school is located in the Mid-Atlantic region and the city population is approximately 426,000. The socio-economic status of the school is mostly middle to upper class. The teachers surveyed taught kindergarten through fifth grade. There were six teachers for each grade level, except for kindergarten. There are only three kindergarten teachers at this school.

The kindergarten teachers have a morning and afternoon class and the fourth and fifth grade teachers team-teach. That is, they either teach language arts and social studies or science and math. A total of thirty-three surveys were distributed and thirty surveys were returned. I chose this particular school because I had heard that it was supposed to be one of the more technologically advanced schools in that area. It has a state-of-the-art computer lab, and the teachers have gone through a computer integration class (for college credit) with a local university.

Materials.

To accomplish my goal, I used a survey. I did so for two major reasons. The first reason was that it allowed me to survey many teachers anonymously. I wanted these teachers to answer the survey honestly. The survey format also allowed me to ask many questions that could be answered quickly. To create my survey, I used questions by Larner and Timberlake (1995) and developed the rest to meet the needs of my study. Looking at the many examples in the rating scale format, I decided to use this scoring system for two reasons. A rating scale format asks the subjects to rate questions on a set number scale. This format allowed the survey to stay simple and quick to complete. Secondly, it allowed me to ask more questions in less time. I had hoped all of this would encourage more teachers to take the time to complete this two-page survey.

There were a total of sixty questions in my survey. These questions were representative of the five areas of questioning: teachers' affect, knowledge, level of computer usage in the content areas, instructional preparation, and school settings.

Domain number one dealt with the teachers' affect and included questions four, eight, and fourteen. Question four asked the teachers how comfortable they were in sharing their computer knowledge. I wanted to see how at ease and confident they felt in sharing what they

knew with others. Question eight asked how comfortable teachers felt with all of the computer terminology. I thought this question might give me some insight into how much of their computer knowledge was technical. Question fourteen asked if they liked to teach with computer technology. I asked this question because I wanted to know if these teachers felt any negativity towards the computer that might influence their level of effective computer integration.

The second domain assessed teachers' knowledge of computer hardware and software, and their overall amount of experience with technology. Questions one, two, three, eleven, twelve, and fifty-six were created to assess this. Of these, question one offered the most useful data. It asked the teachers to rate whether they knew enough to integrate the computer into the classroom. I thought this was a good base line question for knowledge. I also felt that if teachers did not have enough computer knowledge then they would not be able to effectively integrate it.

The third domain dealt with teachers' computer usage in the content areas. Questions thirteen a, b, c, d, e, f, g, and h, thirty-four, and forty-eight were utilized to assess this. Question thirteen asked the teachers to specifically rate which subject areas were integrated with the computer. Question thirty-four served as a follow up to question thirteen. It asked teachers if they integrated the computer with their classroom lessons. I also wanted to see how the teachers rated their level of computer integration. In question forty-eight, I asked teachers to state how often they used the computer for drill-and-practice games. I wanted to know if these teachers utilized the computer more for skill work or creative activities.

The fourth domain dealt with the amount of instructional and preparation time teachers spent on technology. Questions twenty-nine, thirty-two, and thirty-eight were designed to explore this domain. Question thirty-eight asked the teacher if time was the greatest barrier to

their using the computer. I was interested in knowing if teachers felt pressed for time in having to integrate the computer or if it was not a problem. Question twenty-nine asked the teachers whether or not they went to the computer lab every week. I wanted to see whether the teachers viewed the computer as a major priority, and if this resulted in their weekly use of the computer lab. Question thirty-two asked the teachers if they spent the same amount of time preparing for their computer lab time as they did for their other lessons. I asked this question because I thought that if teachers were really using the computer effectively, then they would have to spend the same amount of time preparing for the lessons.

The fifth domain addressed computers in the school setting. Questions twenty-eight, thirty-three and fifty-eight were created to explore this domain. Question twenty-eight asked the teachers whether or not their school had effective in-services. This question was asked to see whether teachers felt they were getting enough help from these in-services. Question fifty-eight asked teachers to state when they would be interested in learning more about technology. I asked this question to see how much time teachers would be willing to put into learning about computer integration. In question thirty-three, I asked the teachers if the main reason to teach with the computer was for the technology Standards of Learning (SOL's). I wanted to know if these teachers were using the technology because they saw it as an enhancement to their instruction or if they used it solely because their schools mandated them to use it.

Procedure.

Each teacher was asked to complete a survey and put it in the attached envelope by the end of the week on which I distributed it. I placed a box in the mailroom for the completed surveys. I prefaced every survey with a letter detailing the role of their survey in my study.

After collecting the surveys, I divided them into the traditional primary and upper elementary grades (primary, kindergarten through third; upper, fourth and fifth). I divided the results to determine whether there would be any differences between the primary and upper grade teachers' attitudes toward technology. Would either group be more enthusiastic about computer usage in the classroom?

Results and Discussion.

In this paper, I will go over those questions that produced the greatest discrepancies and the most interesting answers. I decided to include questions one, four, eight, thirteen a through thirteen h, fourteen, twenty-eight, twenty-nine, thirty-two, thirty-three, thirty-four, thirty-eight, forty-eight and fifty-eight. In this section I will present the results from my study. In certain instances I have combined "strongly agree" and "agree" as well as combining "strongly disagree" and "disagree." I did this because I was not as concerned with the degree to which teachers agreed or disagreed, but whether they showed an overall positive or negative response to the questions.

Affect.

In my study, I asked several questions to assess teachers' feelings on technology. The reluctance felt by some teachers toward computer use is startling to those who are daily computer users. Many teachers, however, feel they have good reasons for not using the computer in their classroom. Hannafin and Savenye (1993) cite some of these reasons as teachers' unwillingness to spend the extra time and effort to learn the new systems, fear of the computer, and fear of losing control of their classroom. In addition, they state that some teachers do not want to compete with the computer for students' attention and they do not believe the computer improves learning outcomes.

Question fourteen (see Figure 1), reveals the degree to which teachers at various grade levels expressed enthusiasm about teaching with computers. Over half of the primary teachers at 55.6% stated that they like to teach with computer technology. This contrasted with 25% of the upper grade teachers who said they liked to teach with computers.

At first, these statistics may seem surprising. However, Melissa Evan-Andris (1995) stated that only 30% of the teachers in her study really liked and used the technology in a meaningful manner. Her population was seventy-two teachers. In my study, I found a slightly higher percentage of teachers who like technology (40.3%). However, this low percentage indicates that teachers may need more and different forms of computer instruction, to help with learning to like computers. If teachers' hearts are not involved in a project, computers will not be used effectively, regardless of how much training he/she receives.

Additionally, neither primary nor upper grade teachers felt comfortable with all of the computer terminology. In question eight, only 16.7% of the upper grade teachers said they felt comfortable with the computer, contrasted with 5.6% of the primary teachers who responded similarly (see Figure 2). Although these percentages seem to be low, these statistics are not too alarming. The goal of educational technology should be at the integration level and not at the specialization level. At the integration level, teachers use the computer as a tool to extend and enhance their instruction. However, at the specialization level, teachers isolate the computer as a separate subject. They spend more time teaching the technical skills than applying the technology into their curriculum (Evans-Andris, 1995). At the elementary level, computers should enhance the curriculum rather than be isolated from it.

For question four, 55.5% of the primary teachers stated they felt comfortable sharing their knowledge, as opposed to the slightly higher 58.3% of the upper grade teachers (see Figure 3).

This seemingly low percentage may be related to the teachers' lack of comfort with the computer terminology or comfort with the programs.

Knowledge.

I was also interested in assessing teachers' level of computer knowledge. In question one, I asked the teachers if they felt they knew enough to integrate the computer into their classroom. Although these teachers claimed to have the necessary computer knowledge, only a small percentage had previously said that they liked to use the technology. For instance, while only 25% of the upper grade teachers said they liked to teach with technology, 83.3% of them felt they knew enough about computers to integrate them into their classroom. This percentage matches exactly 83.3% of the primary teachers who also felt they knew enough to integrate computer technology into their classroom (see Figure 4).

These statistics indicate that although a majority of the teachers think they know enough to integrate technology into the curriculum, they are choosing not to use this medium. This may be related to affect issues noted earlier.

Computer Usage.

Both the knowledge and comfort of teachers leads to the next section of questions. These questions asked teachers exactly how well they used technology. Question thirty-four asked the teachers if they effectively integrated the computer with their lessons. Upper grade (66.7%) and primary grade (61%) teachers claimed to integrate the computer with the lessons they were working on in the classroom (see Figure 5). Judging from this information alone, it might seem these teachers are more technology integrators than technology specialists. This would make sense because these teachers said they didn't feel comfortable with all of the technical computer terms, but they did have enough knowledge to use computers effectively. They would therefore

consider the integration of technology to be more important than the technical specialization of computers.

However, in my survey, I also asked teachers to rate how often they integrate a particular subject with the computer (question thirteen). Surprisingly, although both the primary and upper grade teachers stated they integrated the computer with classroom lessons, primary teachers did so more often and in more subjects. Seventy-five percent of the reading and writing lessons in the primary grades had a computer component (see Figure 6). This result contrasts noticeably with the 29.2% of computer integration in reading and writing lessons at the upper grade level (see Figure 7). In an open-ended question teachers were also asked what role the computer played in their classroom. Only 25% of the upper grade teachers stated reading and writing activities as part of the role of the computer. However, 50% of the primary teachers listed the reading and writing components as an integral part to their computer activities. This difference might be due to the amount of stress placed on language arts at the primary level nationally. However, there are just as many computer resources available for language arts at the upper grade level as those at the primary level.

This same upper/primary disparity appears in the science and math lessons. Primary teachers reported that 50% of them integrated technology into science and math lessons (see Figure 8). Again, only 20.8% of the upper grade teachers integrate science and math with computers. For science integration alone that percentage rose to 25 (see Figure 9). These lower figures for the upper grades seem to indicate that teachers are not adequately using the computer even in their specialty areas.

This upper/primary pattern shows an interesting reversal for the social studies lessons. Only 16.7% of the primary teachers reported social studies lessons integrated with the computer.

In contrast, 50% of the upper grade teachers integrated social studies lessons with the computer (see Figure 10). This statistic indicates that the upper grade teachers who specialize in social studies may be doing a much better job at integrating the computer than those teachers specializing in science and math. Furthermore, the noticeable drop in primary teachers using the computer for social studies lessons may indicate that they either do not have enough knowledge in that area or they place more computer relevance on reading, writing, science, and math activities.

The last major content area I studied was health. I found that only 16.7% of the primary teachers said they used the computer in health lessons. This percentage drops to 8.3% for upper grade teachers who said they integrated computers with health lessons (see Figure 11). These low statistics may indicate the lack of knowledge on integrating these two subjects or the lack of desire to use health and computers together.

When it came to the uses of computers in the arts, percentages drop considerably. Only 16.7% of primary teachers said they used computers with art lessons. The upper grade teachers said they never used the computers for art lessons. Additionally, neither group ever used the computer for music lessons (see Figure 12). Perhaps these figures might be lower because the students go to special classes for these subjects. Therefore, some teachers may consider these areas unimportant to their regular classroom lessons.

Instructional and Preparation Time.

When teachers were asked, on question thirty-two, if they spent the same amount of time preparing for the computers as they do for their other lessons, only 38.9% of the primary and 41.7% of the upper teachers said they actually spent the same amount of time (see Figure 13).

This may signal that one reason why some teachers may not effectively use the computer is merely because they are not putting enough time into their lessons.

Time was, in fact, considered the greatest barrier to using the computer. Sixty-six percent of the primary teachers and 66.7% of the upper grade teachers agreed with this statement in question thirty-eight. If time is the greatest barrier for these teachers, this may explain the lack of time spent on preparing for computer instruction.

When considering the reports of scheduled computer time usage, the primary/upper grade distinctions were again present in question twenty-nine. While 71.1% of the primary teachers did go to the lab every week, only 16.7% of the upper grades went at their scheduled times (see Figure 14). This tells me that although the primary teachers feel pressed for time both in making and using the computer lessons, they still place a high priority on them. However, the upper grade teachers do not spend the same amount of time on the lessons, nor do they seem to place a high value on going to the lab every week.

Computers in the School Setting.

Given the lack of computer integration across all of the subject domains, one might think these teachers need more effective in-services. However, 55.6% of the primary teachers and 58.3% of the upper grade teachers said their school had effective in-services for integrating the computer with the curriculum in question twenty-eight (see Figure 15). These responses suggest that either the teachers are choosing not to integrate technology throughout their curriculum or the in-services are not as helpful as they originally thought.

When I asked the teachers if there were preferred times to learn more about computers in question fifty-eight, the results again indicate differences between primary and upper grade teachers. The primary teachers stated that 16.7% would prefer a one-day session as opposed to

33.3% of the upper grade teachers. Only 11.1% of primary teachers said they would like to learn the new technology in a session that lasted a couple of days. This was compared to the 16.7% of the upper grade teachers. Just 44.4% of the primary teachers said they would like a two-week class, as opposed to 25% of the upper grade teachers. A mere 11.1% of the primary teachers and 8.3% of the upper grade teachers were willing to take a 5-6 week class. However, another 16.7% of both primary and upper elementary teachers said they were interested in an alternative setting for the instruction. Some of the suggestions given were a week in summer, anytime available, on school contract time only, short specific in-service and sharing only on grade level. Interestingly, an additional 25% of the upper grade teachers said that they were not interested in learning more about the computer. These results suggest that although a major portion of teachers said they wanted to learn more about technology, only a few are willing to spend their free time learning this new medium.

This negative attitude reappeared when I asked if the main reason to teach computers were solely for the technology SOL's in question thirty-three. Astonishingly, 41.6% of the upper grade teachers said they agreed and surprisingly 44.5% of the primary teachers agreed as well (see Figure 16). This question is significant because it shows that almost half of the teachers feel that the only reason they are teaching with the computer is because they have to. This adds weight to my earlier thought that we need to change the way teachers feel about computers before we can teach them how to effectively use the computers in their classrooms.

Conclusions.

Overall, a majority of the teachers surveyed stated they did not like to teach with technology. In addition, almost half of the teachers said that the technology SOL's were the major reason for using the computer. This negative stance is reflected in their avoidance of

interactive uses of technology. Although 61.1% of the primary and 66.7% of the upper grade teachers report integrating computers across the subject domains, my results indicate that this is not the case. Teachers are, in fact, only integrating it within some of their subjects. Primary teachers note a high level of integration with language arts, science, and math. However, they have a low integration level with social studies, health, art and music. These lower levels of integration are not as contradictory as the stated upper grade teacher levels on integration. The upper grade teachers have a low level of integration with language arts, science, health, art and music. However, they do appear to have a very good level of computer integration with social studies.

It is important to note that 44.5% of primary teachers and 50% of upper grade teachers use the computer for drill-and-practice games, as stated in question forty-eight. So, even when they are integrating computers into the different subject domains, exactly how well is another question that is brought into this discussion. If these teachers are only putting a drill math or social studies game in front of the child, they may not always be effectively integrating the computer with their classroom content. Many times, these software programs have their own objectives that do not match the classroom objectives. The computer is a tool that needs to be integrated with the classroom content. Jonassen, Carr, and Yueh (1998) state that the computer should enhance the student's thinking and learning and not control the objectives of the classroom.

Both primary and upper grade teachers state they have the knowledge to be effective technology integrators. A little over half of both primary and upper grade teachers feel they have had effective in-services on integrating computers into the curriculum. In addition, both 83.3% of primary and upper grade teachers stated they knew enough to effectively integrate computers.

However, neither group spent the same amount of time preparing for these lessons as they did for their other classroom subjects.

A majority of teachers blame time as the greatest barrier to their successful integration of computers. This was evident not only in their lack of computer preparation, but the usage as well. While 71.1% of primary teachers go to the computer lab every week, only 16.7% of upper grade teachers reported using the computer lab every week. Furthermore, although a major portion of teachers said they wanted to learn more about technology, only a few were willing to spend over a month learning this technology. Most of the primary teachers (44.4%) said they would like a two-week class. However, the upper grade teachers (33.3%) said they would like a one day session, a two-week class (25%) or they were not interested at all (25%). This frustration with time commitments is understandable; still, teachers should not expect their students to learn new material overnight, nor should they expect themselves to learn a new technology overnight.

Implications.

The benefits of using technology in the classroom are numerous. Nevertheless, Butzin (1992) has noted that "teachers today are overwhelmed. Asking them to use technology extensively on top of everything else is imposing a burden that few can bear"(p. 331). However, if teachers are shown how this technology will enhance their teaching in a time effective manner, I think more teachers would try to effectively incorporate computers into their teaching. Once the basics are learned, technology does not have to be a time consuming process. The following suggestions and ideas keep in mind these time constraints and consider how to support teachers.

Pre-services and in-services.

Integrating technology is an important issue in elementary classrooms today. In 1994, the National Council of Accreditation of Teacher Education (NCATE) mandated the use of technology into all pre-service teacher programs (Taylor and Stuhlman, 1995). However, it has been reported by the Office of Technology Assessment (OTA) that "despite greater availability of technologies in schools, teachers report little use of technology, and that most teachers have not had adequate training to prepare them to use technology effectively in teaching" (Wetzel, Zambo, Buss and Arbaugh, 1996, p. 196). Furthermore, as a 1997 college graduate with a licensed teaching certificate, I never once took a computer course, nor was I asked to or given the opportunity to take this type of course in my undergraduate program. It was not until I started my master's program at the University of Virginia that I elected to take computer classes specifically for teachers. Through these classes, I now feel confident to effectively integrate technology across the elementary curriculum.

If current teachers such as those I surveyed and other recent teaching graduates (my fellow 1997 classmates) do not have any preparation in educational technology, where do we start teaching about technology? The answer is to teach both current teachers and pre-service teachers at the same time. Some universities and colleges are now showing teachers and students how to effectively integrate the computer through programs such as TIP. TIP, the Technology Infusion Program at the University of Virginia, is interesting as a model to consider.

In this program, current teachers are matched with college students who are taking courses in educational technology. Together, the teacher and student design a project for the elementary school students to complete. As with the teachers I surveyed, current classroom teachers will have some experience with technology, but perhaps do not know how to extend it

successfully. Through this program, the college student is able to share the most up-to-date computer knowledge and receive the hands on experience of applying it in a "real-life" classroom setting. This is a win-win situation. The teacher sees and practices this new use for the technology with the college student and his/her classroom students during school contract hours. Additionally, the college student gets the hands on experience needed for his/her degree program.

Unfortunately, not all schools are benefiting from these programs. Ideally, only one teacher from each school should be picked each year. This way, the college students are spread throughout the school system and bring more schools up to date. Additionally, this one teacher, taught through this TIP program, should then be able to return and share his/her knowledge with fellow teachers. A survey in 1993 stated that the in-services alone were not enough for the teachers. Even those schools which had many in-services, had teachers reporting the need for more training (Bull, Hochella, Becker, Miles and Tate, 1994).

Effective Integration.

So what sort of training might show how to effectively use educational technology? The first training that is needed is in the basic programs. Considering that approximately half of the school I surveyed worked with drill-and-practice games, this basic training seems greatly needed. Teachers have been instructed on how to use creativity in their regular classroom. However, most teachers have never been taught nor involved in discussions on how to be creative with a computer.

The drill-and-practice computer games became an easy way for teachers to say that they were trying to incorporate technology into their curriculum. Although the drill-and-practice

games occasionally work on skills needed for class, the majority of the time the computer has control of the child's efforts. The teacher instructs the students to turn on the computer and then the computer becomes the teacher and evaluator. This contrasts with a more current model in which the learner functions as the designer of the project and the computer functions as the "Mindtool." The computer should interpret and organize this student's ideas into a visually appealing and easily understood format (Jonassen, Carr, Yueh, 1998). The computers should require students to think about what they know in different and meaningful ways. Otherwise, the computer becomes nothing more than a drill worksheet. A good rule of thumb to follow is if the activity could be done just as well with paper and pencils, then it is probably not the most efficient activity to complete on the computer.

Through programs such as Claris Works, Hyperstudio, and Kid Pix, the learner scaffolds his/her knowledge through many different levels. In these programs, the learner needs to enter the data before the computer will do anything meaningful. The plan is not already set up for the students to complete. They must choose their own way of developing and solving their problems. In the next section, I will describe activities that use these programs in a "Mindtool" manner. To complete these projects, the teachers must have a basic understanding of each program.

Claris Works can be used to keep writing journals. Ithel Jones (1994) states that "the use of word processors by second grade elementary school pupils results in an overall improvement in the quality of their writing and, at the same time the stories written by these pupils tend to be longer" (p. 52). These students were said to be less focused on the mechanics of their writing and more concerned with the development of their ideas. If the goal of the writing activity is to practice handwriting, then the computer is an inappropriate choice. However, if the goal is to

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have the students write stories or keep journals, then the computer may be a beneficial alternative.

Spreadsheets are also another beneficial tool to use with children. Ploger, Rooney, and Klinger (1996) state that "computer spreadsheets have become essential tools in the modern workplace, making tedious bookkeeping tasks much more manageable" (p. 26). The possibilities can be endless with this tool in the classroom. For example, the students could either chart their weather temperatures from their surrounding cities or go onto the Internet and choose a city from a site such as http://www.weather.com/weather/us/.

For example, each child could chart three cities. At the end of each month, each student could make a simple spreadsheet that shows other children the differences in temperatures throughout the month. The bar graphs, pie charts, etc. provide a nice visual summary that is easy for students to interpret. For the younger children, a spreadsheet using clip art can be developed. The students might draw three columns (one for each city) using a draw program (Claris Works or Kid Pix). The students should have at least a sun icon, a rain icon, and a cloud icon. Each day the children should stamp one or two icons showing what the weather was like that day. The students should then summarize the information weekly, signifying which weather condition occurred most frequently throughout that week in that particular city. A bar graph can then be stamped showing which weather condition occurred the most throughout each of the weeks during that month.

Spreadsheets can also be used to show students in the upper grades how to keep track of their grades, save/spend their money, as well as the expenses in raising a family today based on housing, food, clothing, and other expenses. Through completing these activities, the students will be dealing with real life issues while using math concepts of averages, expenditures, income,

etc. Frances Clark (1998) designed a pizza unit for her students. She also wanted to connect their math concepts to a unit on the computer. The students worked in groups divided into specialty departments. The different groups were accounting, sales, advertising, product development, and marketing. Each group had both technology and curriculum objectives. The marketing department had to create and conduct a survey to determine what kind of pizza each grade level liked best. The graphic design department created an original logo for the pizza restaurant. The sale department obtained information about the shapes, sizes, and costs of pizza and created a spreadsheet to help determine which shape pizza was the best value. The product development department created an original pizza recipe and entered it into a database that helped analyze the nutritional value of the pizza ingredients. The advertising department created a television script for a commercial that would advertise their pizza restaurant (Clark, 1998). These students were using not only technology skills in this project, but they were integrating all of their subject areas together as well. They also "learned how to use basic computer applications similar to how they are used in the workplace" (p. 46).

The Hyperstudio program can help create electronic portfolios. Tuttle (1997) defines an electronic portfolio as "a concise, annotated collection of student work that reflects educational standards" (p. 33). Good electronic portfolios are said to include the following:

- Introduction to the portfolio
- A background on the student
- School expectations and competencies needed
- A variety of student work
- A rubric (evaluation) of the work

- Student's introspection on their work
- Teacher comments
- A synopsis of the student's work (Tuttle, 1997).

Portfolios enable the child to have their best work all in one easy to read document. They can show this not only to parents and relatives, but to future teachers as well. These portfolios could help a future teacher see the student's developmental stage, the level of mastery on a topic and the level of instruction needed to continue the student's growth.

Hyperstudio can also be used to demonstrate a student's level of knowledge on a particular topic. For instance, a nutrition stack can be made showing which foods are healthy, what a proper diet includes and the importance of exercise. I also had a second grade class work on a Hyperstudio stack for their Social Studies unit. We created stacks for Ancient Greece, Ancient China, China, Greece, and Australia. These students first researched the land, native foods, religion, natural resources, people, and animals for each country. Each student wrote a summary of their topic in the Claris Works program and then illustrated a picture to go along with the text in Kid Pix. I had a template already created in Hyperstudio and just pasted each text and picture onto a new card. The cards were then combined using buttons. The final product allowed the students to move from country to country and read all about the characteristics of each on their own reading level.

One final activity that would introduce parents to the technology in the classroom is a computer slide show. Many teachers display the students' work at their desks or on the walls, or have some creative activity they do especially for Parents' Night. Technology is not usually included. However, with Claris Works, the students can show parents a few basic ideas of what

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they do with the computer. Each student could create one page on a Claris Works draw page. Each student might complete a page for a unit of study that they will be working on that semester. For instance, one child could illustrate a picture of a space unit with a brief statement of what he/she hoped to learn from this unit of study. All of the children should also have their names written somewhere on their page where it will be easy to read. All of their pages could be saved on the same document. When the parents come to open house, this document could be run as a slide show. Parents would get to see their child's computer work as well as specific units that they will be working on that semester. This program can be hooked up to a television (if available) for easier viewing. A program such as the Apple Presentation System will be needed for hooking up the cables from one system to the other.

Present and Future Research.

There are many ways to effectively integrate the computer into an elementary classroom. However, there is not enough paper in the world to write them all down, nor is there ever enough paper to write down every non-technology classroom idea. The best that teachers can do is to start compiling a list of the ideas that we get from other people, along with thinking a little more creatively ourselves.

A good place for us to begin is to look at the curriculum goals and then think of how to extend and expand on that idea with the help of computer technology. The computer is an everyday tool in the child's outside life, so why can't we make it an effective tool in the classroom? Computers are typically integrated into more language arts programs, but I challenge teachers to find ways to use it in the other content areas as well.

In this paper I focused on the computer implications of technology. However, technology does include camcorders, video, instructional television, videodiscs and CD-ROM (Barnett and

Nichols, 1994). Everyday we are seeing more of these integrated with the computer. For example, movies and music CD-ROMs are being imported into computer programs. Some of these techniques are more advanced than the activities that I have suggested. If teachers are novice users, they should start out small and later go into loftier ideas. Also, we must remember the children we are teaching today are often more familiar with computers than some teachers. Teachers should not be afraid to ask the students for ideas as well. Once they know they can use the computer, students will come up with more ideas than are needed just to use the computer. As Boyer and Semrau (1995) state, the "teacher's role has changed from the traditional giver of knowledge to a facilitator or coach who provides authentic activities and who shares with students in the process of evaluating and critically reflecting on what learning is taking place" (p. 15). Furthermore, Semrau and Boyer (1995) state there should be "less use of lectures, memorization and reliance on textbooks. Learning outcomes focus on the process of students constructing their own knowledge and the students' reflection on that process" (p. 4).

Teachers typically use computers in their class letters, tests, handouts, etc. but we also need to make sure that we use them throughout the lessons. If the teachers think the computers are important enough to their classroom management, then they should also incorporate them into their classroom instruction for the same reason (Barnett and Nichols, 1994). Computers not only aid instruction, but also enhance and speed up the amount of labor. However, students do need to practice without the technology at times.

This paper was not intended to argue for the usage of computers at all times. Instead, what I have suggested is that computers be integrated into the school curriculum just as the environment has integrated computers throughout. The computer revolution did not happen overnight, nor is it a good idea to jump headfirst into the curriculum with it. However, we do

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need to take a look at those teachers who have not jumped in at all in over five years! If these fearful teachers are in the fourth and fifth grades, they could negatively impact their students' progress, considering that their students may be tested on technology, such as Virginia's fifth grade SOL test. Unless their primary teachers developed a positive attitude towards computers, children could possibly score lower after completing these last two elementary grades. However, further research will need to be done to support this statement.

As Green (1996) and I have stated before, "the best learning occurs with a variety of learning experiences" (p. 1). Although this paper took a look at teachers' attitudes and effective computer integration in the elementary school, my results were based on just one school's survey. For future research, I would like to survey more schools and complete observations on teachers actively or non-actively using the computer in their classroom. As we approach the next century, I think we will see even more research into this area of our school curriculum. More parents want their children to get a jump-start on the business world, and the way they see this occurring is through technology. However, it is important to stress that the learning on computers be in a friendly and useful atmosphere, so that students and teachers develop a life-long appreciation for computers and realize all of the benefits to technology.

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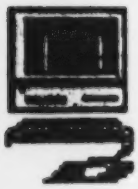
Appendix

Computer Survey



Computer Survey 1998

Dear Teachers,

Hi, my name is Christen Cummings and I am currently working on my M.Ed. in Elementary Education at the University of Virginia. I am beginning to work on my final project for my degree and could use your help. I am researching the role that computers play in some classrooms over others. I am conducting a voluntary survey and would greatly appreciate your participation. The survey will only take a minute to complete and will greatly help my study. Your name will not be included, so please be honest in your answers. When you have completed the survey please place it in the attached envelope and put it in the office box marked computer surveys by no later than _____.

Thank you in advance for your participation.

Sincerely,

Christen Cummings

Grade/Subject(s) you teach_____

Please rate the following questions according to the following scale:

1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree

1. I know enough about computers to integrate them into my classroom.	1	2	3	4	5
2. I see myself as one of the more knowledgeable computer users in my school.	1	2	3	4	5
3. Other school personnel see me as one of the more knowledgeable computer users in my school.	1	2	3	4	5
4. I feel comfortable sharing my knowledge about computers with other faculty.	1	2	3	4	5
5. I feel comfortable using the computer with my class.	1	2	3	4	5
6. I feel tense when people start talking about computers.	1	2	3	4	5
7. I feel intimidated by people who know something more about computers than I do.	1	2	3	4	5
8. I feel comfortable with all of the computer jargon.	1	2	3	4	5
9. I feel pressure from others to integrate the computer more into my classroom.	1	2	3	4	5
10. I feel that I have more knowledge on computers than my students do.	1	2	3	4	5
11. I have taken courses in instructional technology.	1	2	3	4	5
12. I have attended in-services that focus on instructional technology.	1	2	3	4	5
13. I integrate computers into my:					
A. Reading Lessons	1	2	3	4	5
B. Writing Lessons	1	2	3	4	5
C. Science Lessons	1	2	3	4	5
D. Math Lessons	1	2	3	4	5
E. Social Studies Lessons	1	2	3	4	5
F. Art Lessons	1	2	3	4	5
G. Music Lessons	1	2	3	4	5
H. Health Lessons	1	2	3	4	5
14. I like to teach with computer technology.	1	2	3	4	5
15. I think quality instruction using technology will enhance my teaching.	1	2	3	4	5
16. I enjoy learning about new technology.	1	2	3	4	5
17. I wish I could find a way to have my students use computers more than they do now.	1	2	3	4	5
18. I enjoy reading about new computer software and hardware.	1	2	3	4	5
19. I rely on others to inform me about new software.	1	2	3	4	5
20. I think that using computer technology for instruction will help improve my students' performance.	1	2	3	4	5
21. When using computers, the teacher becomes the guide/facilitator.	1	2	3	4	5
22. Computers allow me to individualize instruction.	1	2	3	4	5
23. I think computers are dehumanizing.	1	2	3	4	5
24. I think students are motivated when they can learn using computer technology.	1	2	3	4	5
25. I think computer instruction is just another fad.	1	2	3	4	5
26. When using computers, the teacher's role becomes more complex.	1	2	3	4	5
27. When using computers, my role is diminished.	1	2	3	4	5
28. My school has helpful in-services for integrating computers into the curriculum.	1	2	3	4	5
29. I go to the computer lab every week at my scheduled time.	1	2	3	4	5

30. I try to go to the computer lab on extra days when I know it is open.	1	2	3	4	5
31. I have previewed all software before I use it with my class.	1	2	3	4	5
32. I spend the same amount of time preparing for my computer lab time as I do for my other lessons.	1	2	3	4	5
33. The main reason I use the computer is to teach the technology SOL's.	1	2	3	4	5
34. I integrate my computer lessons with the lessons we are working on in the classroom.	1	2	3	4	5
35. Technology should be taught in a context that's distinct and separate from the curriculum.	1	2	3	4	5
36. I create my own projects for my students to complete on the computer.	1	2	3	4	5
37. If my students can only get into the computer lab once a month, I feel good.	1	2	3	4	5
38. The greatest barrier to using the computer is time.	1	2	3	4	5
39. I feel that I have had adequate training in using computers.	1	2	3	4	5
40. I believe that I effectively use the computer in my classroom.	1	2	3	4	5

Please Use the Following Scale to rate how often you use the following:

1-Never	2-Infrequently (1-2 times per year)	3-Sometimes (2-3 times a semester)	4-Often (Usually when I have access to technology)	5-Always (Whenever I have access to technology)

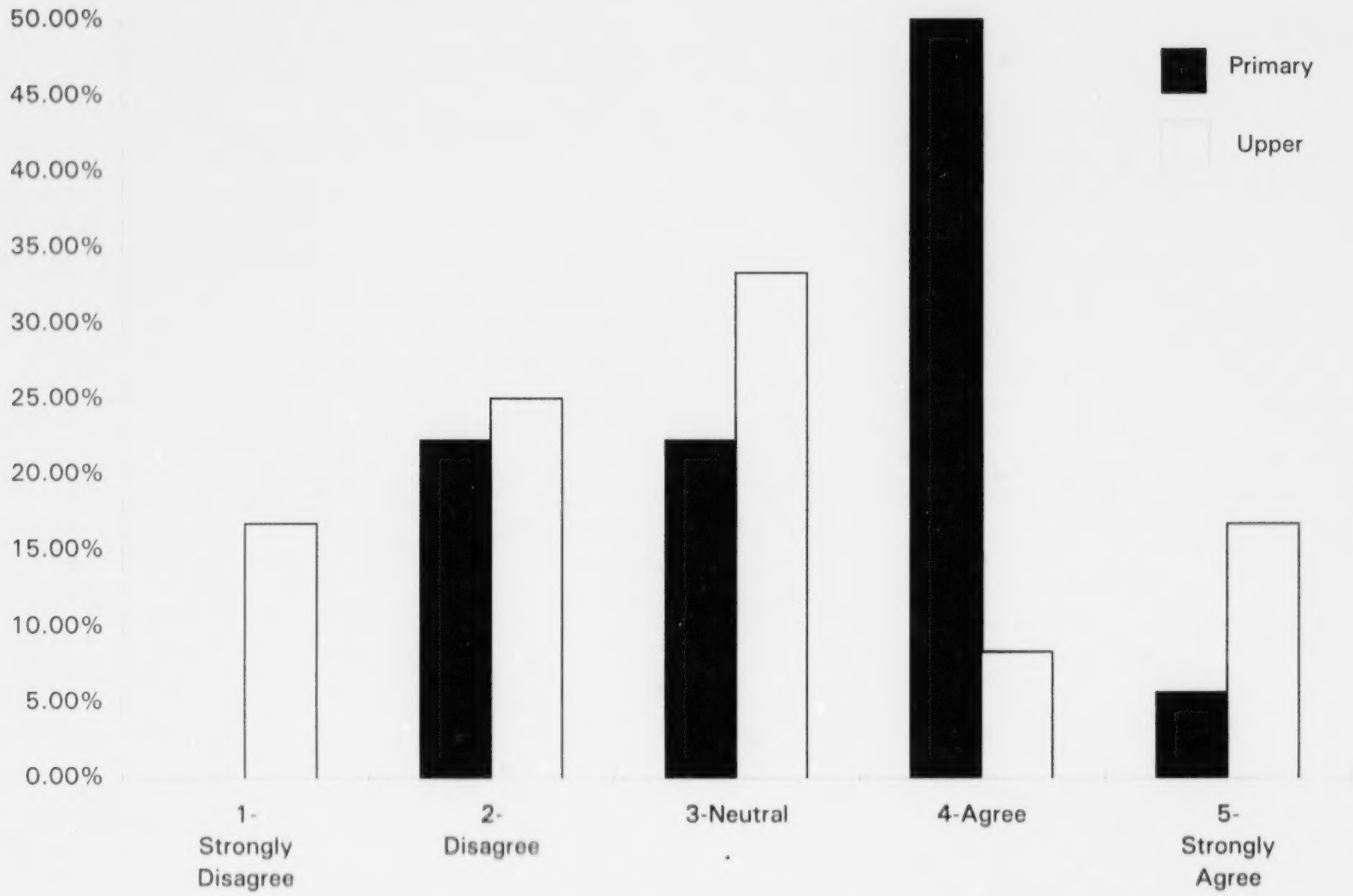
41. Claris Works	1	2	3	4	5
42. Microsoft Word	1	2	3	4	5
43. Spreadsheets/Databases	1	2	3	4	5
44. Other Word Processing/Publishing Program	1	2	3	4	5
45. Kid Pix	1	2	3	4	5
46. Super Paint	1	2	3	4	5
47. Other drawing/painting programs	1	2	3	4	5
48. Drill and Practice Games (Number Munchers, etc)	1	2	3	4	5
49. Oregon Trail	1	2	3	4	5
50. Carmen San Diego	1	2	3	4	5
51. Other Software Game simulations	1	2	3	4	5
52. Keyboarding	1	2	3	4	5
53. Other_____	1	2	3	4	5
54. I use the computer for my own personal usage.	1	2	3	4	5
55. I have and use a personal e-mail account.	1	2	3	4	5

56. In the past 4 yrs., the no. of formal hours of computer training I have had is (Total hrs. not credit hrs.)
    a. Less than 4 hours b. 4-7 c. 8-11 d. 12-15 e. over 15
57. I am scheduled to use the computer in:
    a. The morning b. Early afternoon c. Late afternoon
58. I would be interested in learning more about computers in the following setting.
    a. Not interested b. One day session c. In a couple of days
    d. 2-4 week class e. 5-6 week class f. Other_____
59. What would you like to learn more about on the computers?

60. Please explain the role that computers play in your classroom?

Figure Caption

Figure 1. Levels of expressed enthusiasm toward teaching with computers by primary and upper grade teachers.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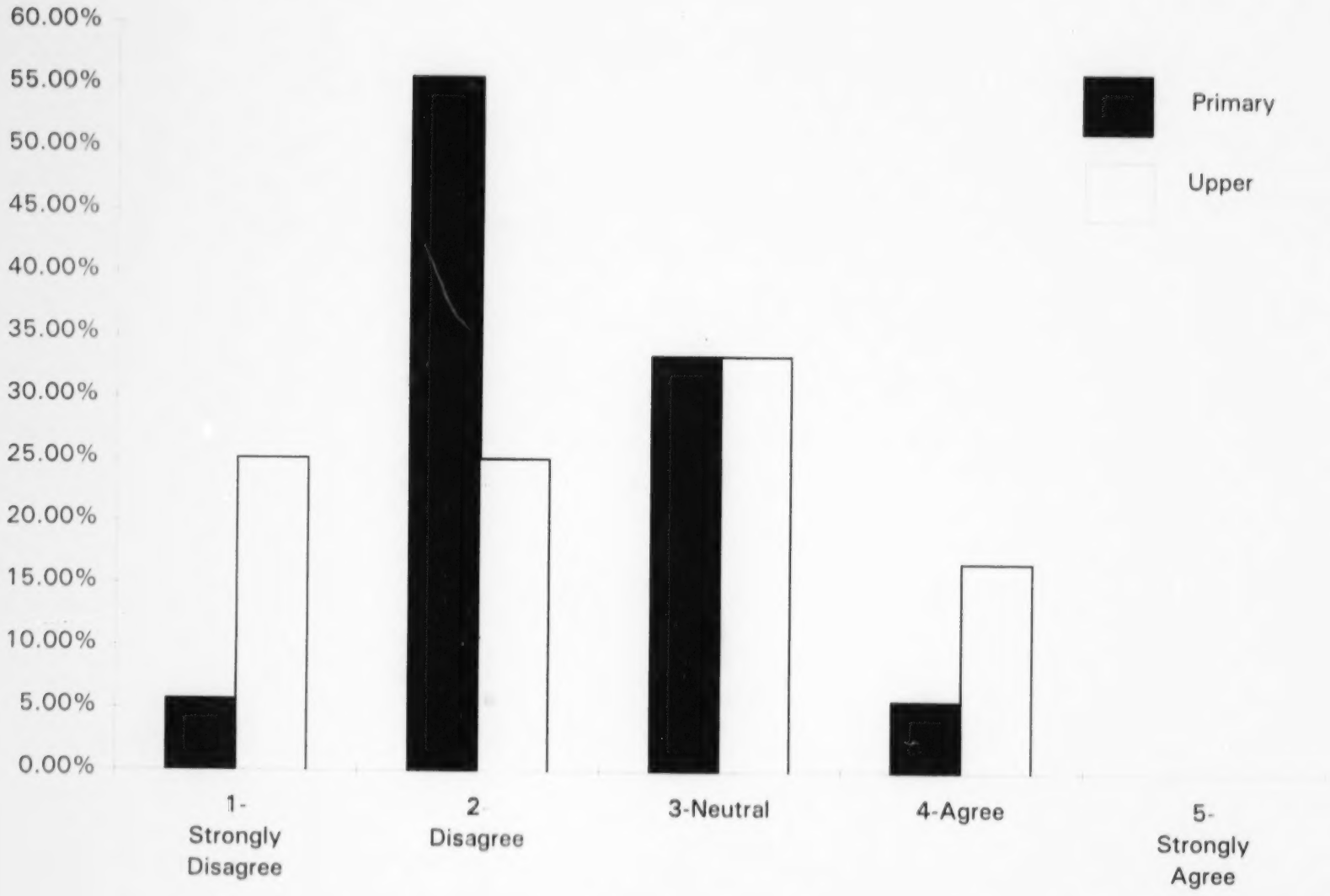
Primary
Upper
1- Strongly Disagree
2- Disagree
3-Neutral
4-Agree
5- Strongly Agree

Figure Caption

Figure 2. Reported levels of comfort with computer terminology by primary and upper grade teachers.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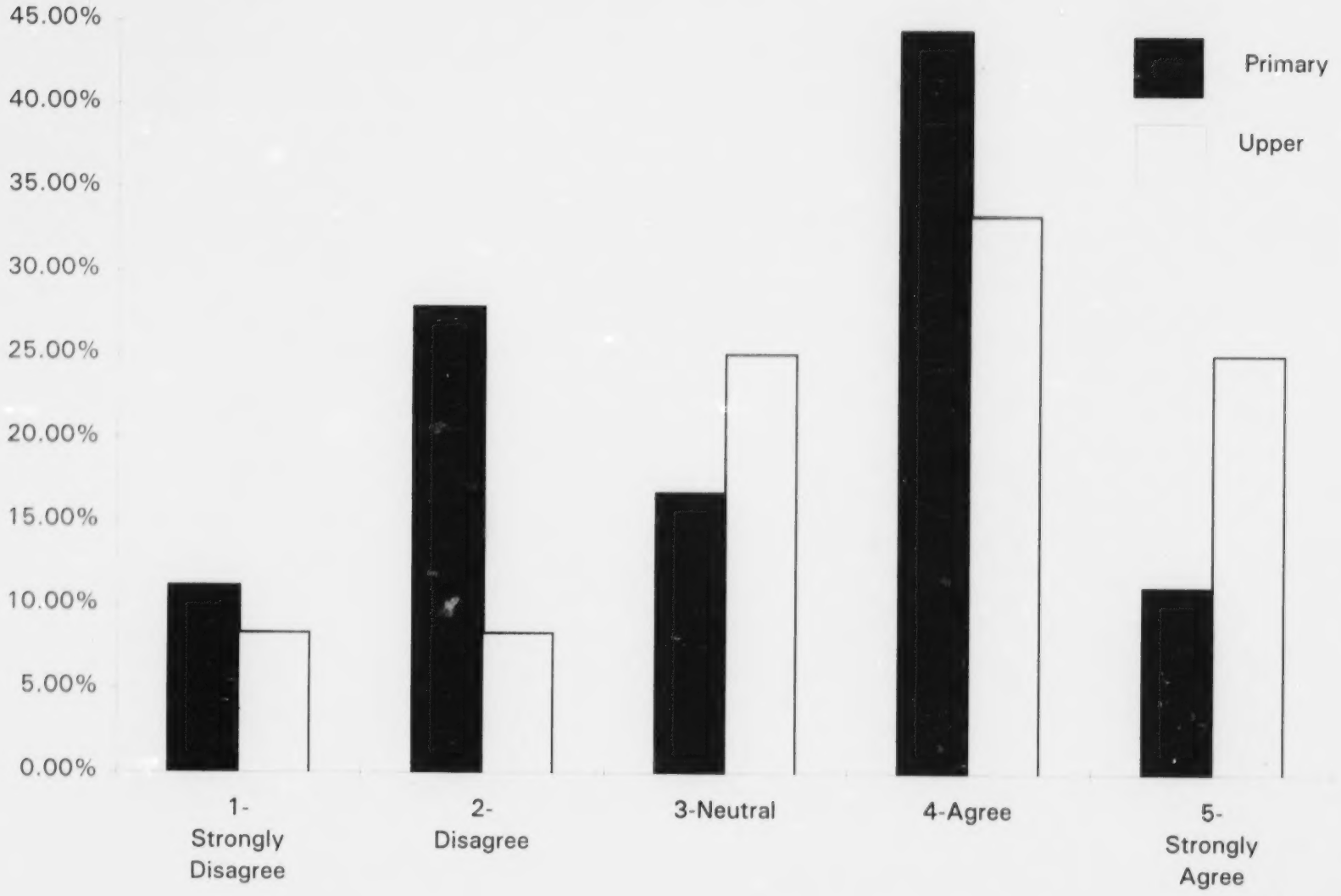
Primary
Upper
1-
Strongly
Disagree
2
Disagree
3-Neutral
4-Agree
5-
Strongly
Agree

Figure Caption

Figure 3. Primary and upper grade teachers reported levels of comfort with sharing their computer knowledge with others.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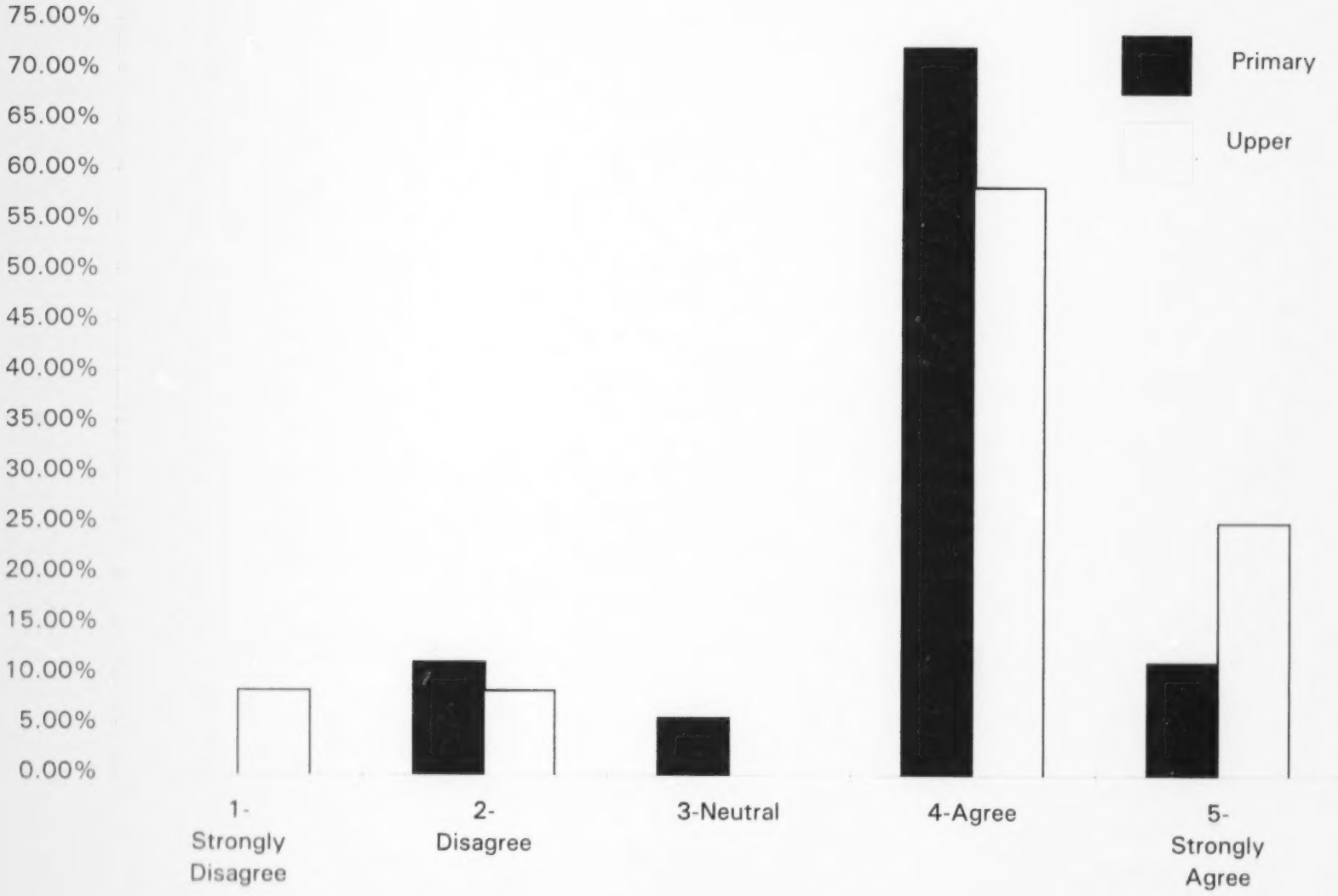
Primary
Upper
1- Strongly Disagree
2- Disagree
3-Neutral
4-Agree
5- Strongly Agree

Figure Caption

Figure 4. Primary and upper grade teachers stated level of knowledge for effectively integrating the computer into classroom lessons.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Primary
Upper
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3-Neutral
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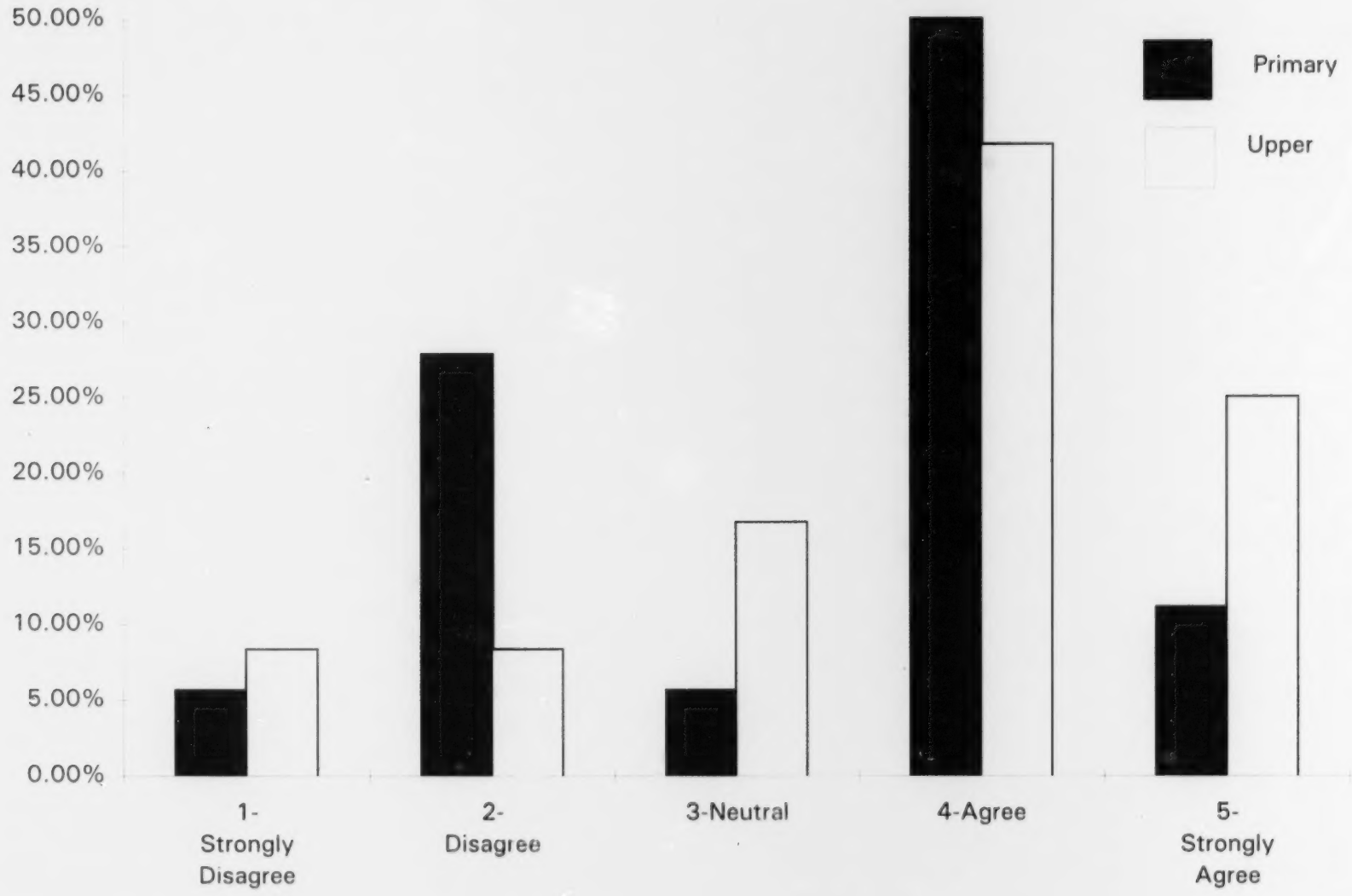
5- Strongly Agree

Figure Caption

Figure 5. Primary and upper grade teachers reported levels of computer integration with classroom lessons.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3-Neutral
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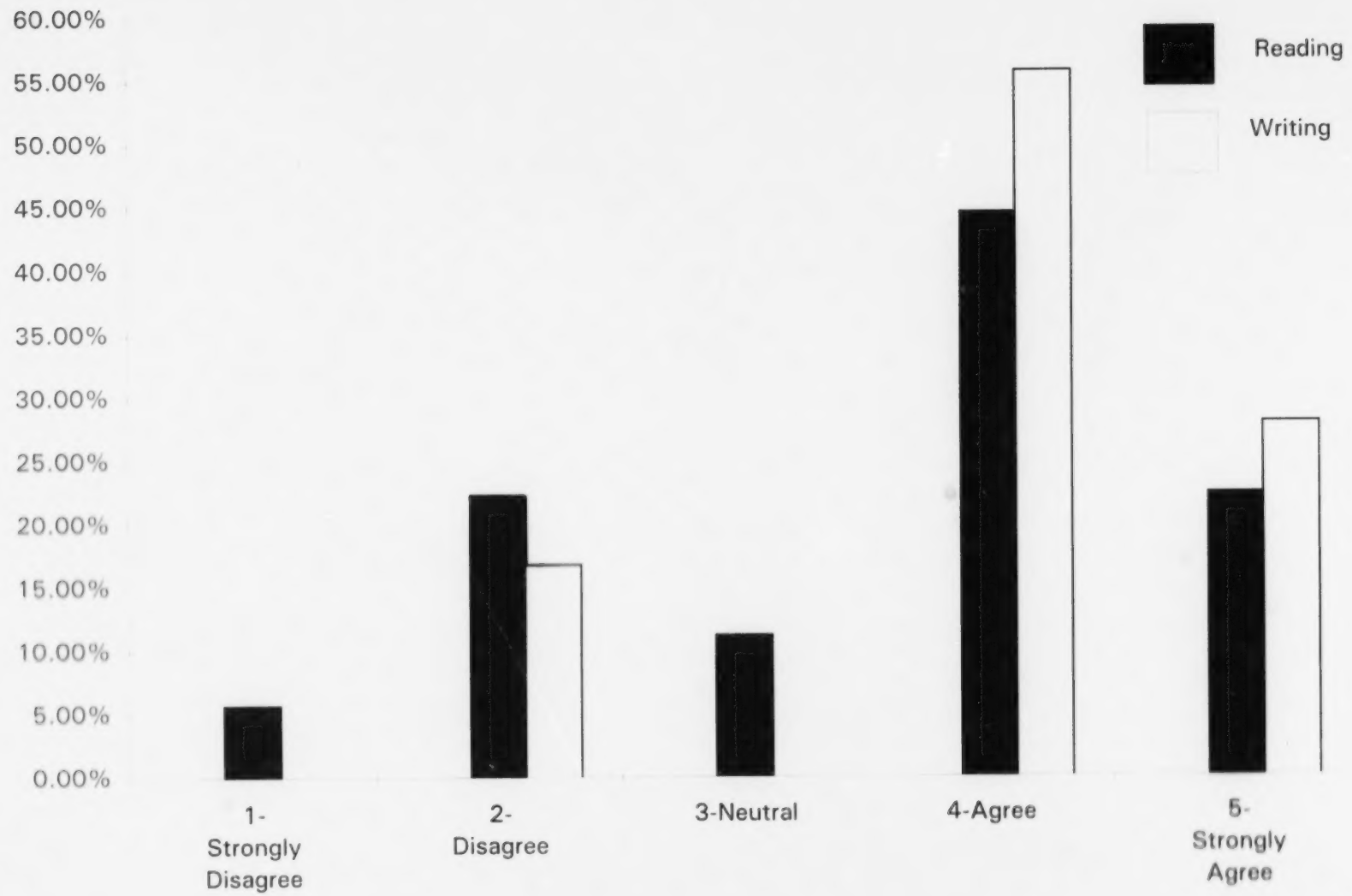
5- Strongly Agree

Figure Caption

Figure 6. Primary teachers' ratings on their levels of computer integration with reading and writing lessons.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Reading
Writing
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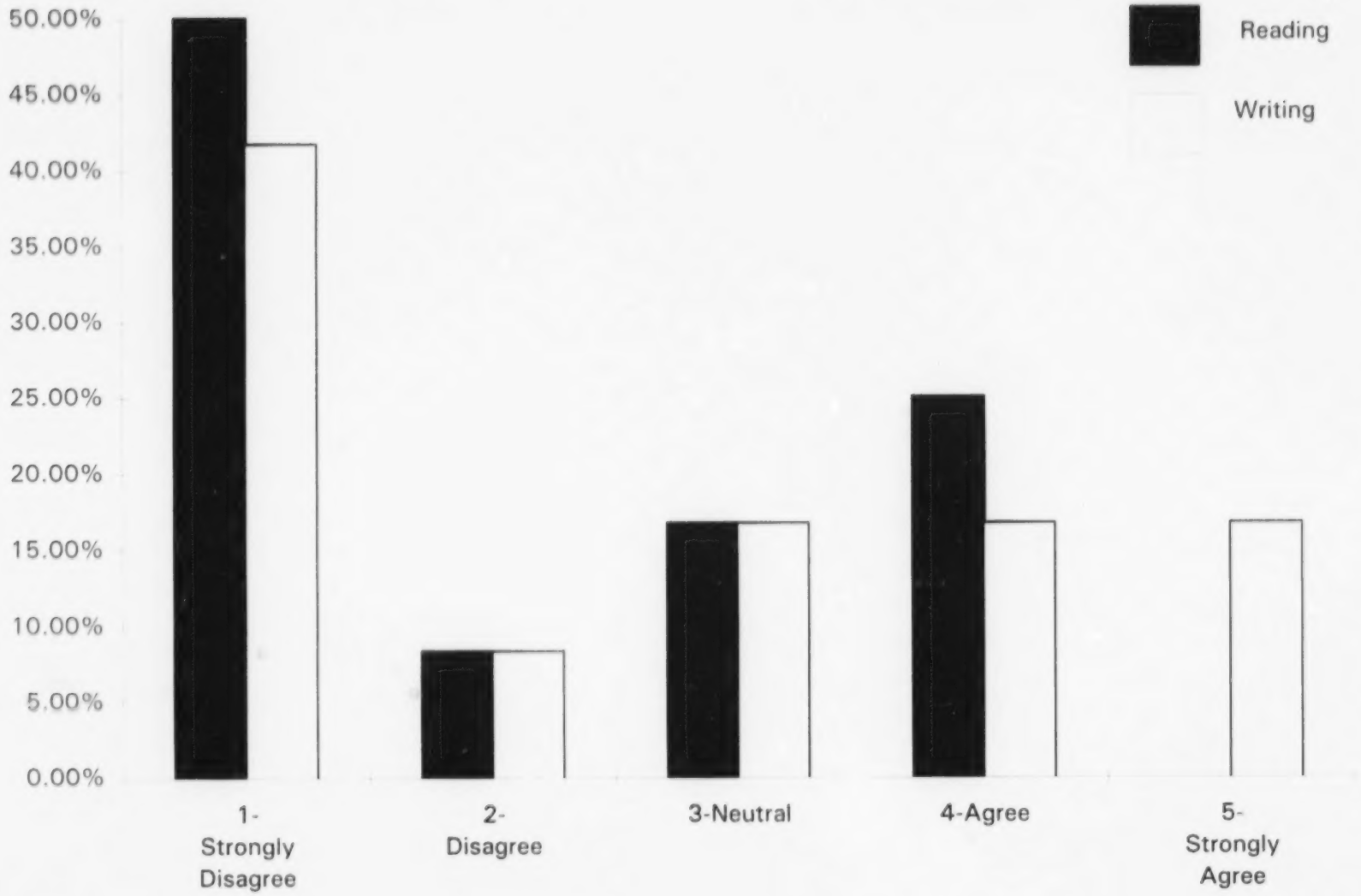
5- Strongly Agree

Figure Caption

Figure 7. Upper grade teachers' rankings on their levels of computer integration with reading and writing lessons.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Reading
Writing
1- Strongly Disagree
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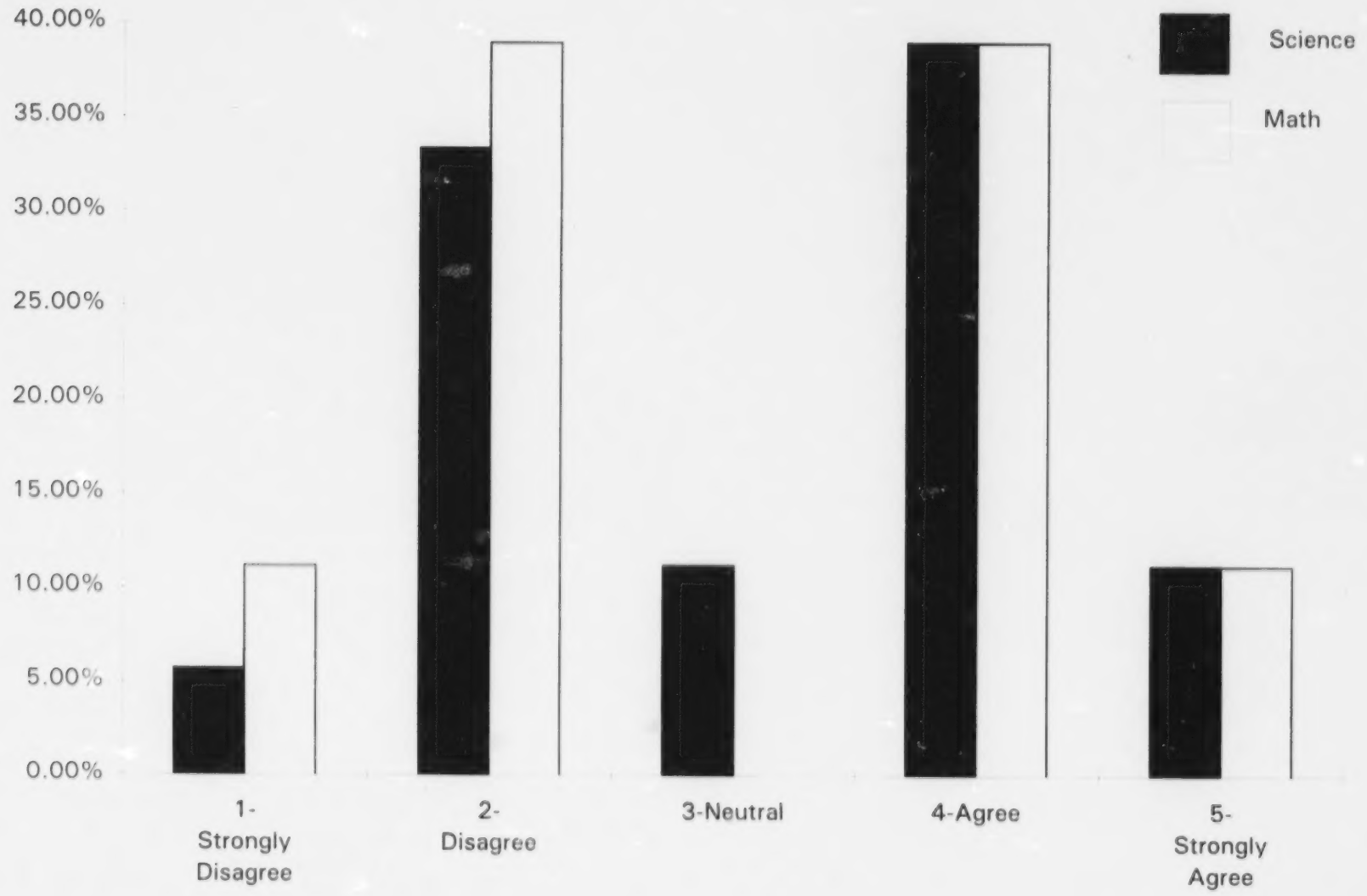
3-Neutral
4-Agree
5- Strongly Agree

Figure Caption

Figure 8. Primary teachers' ratings on their levels of computer integration with science and math lessons.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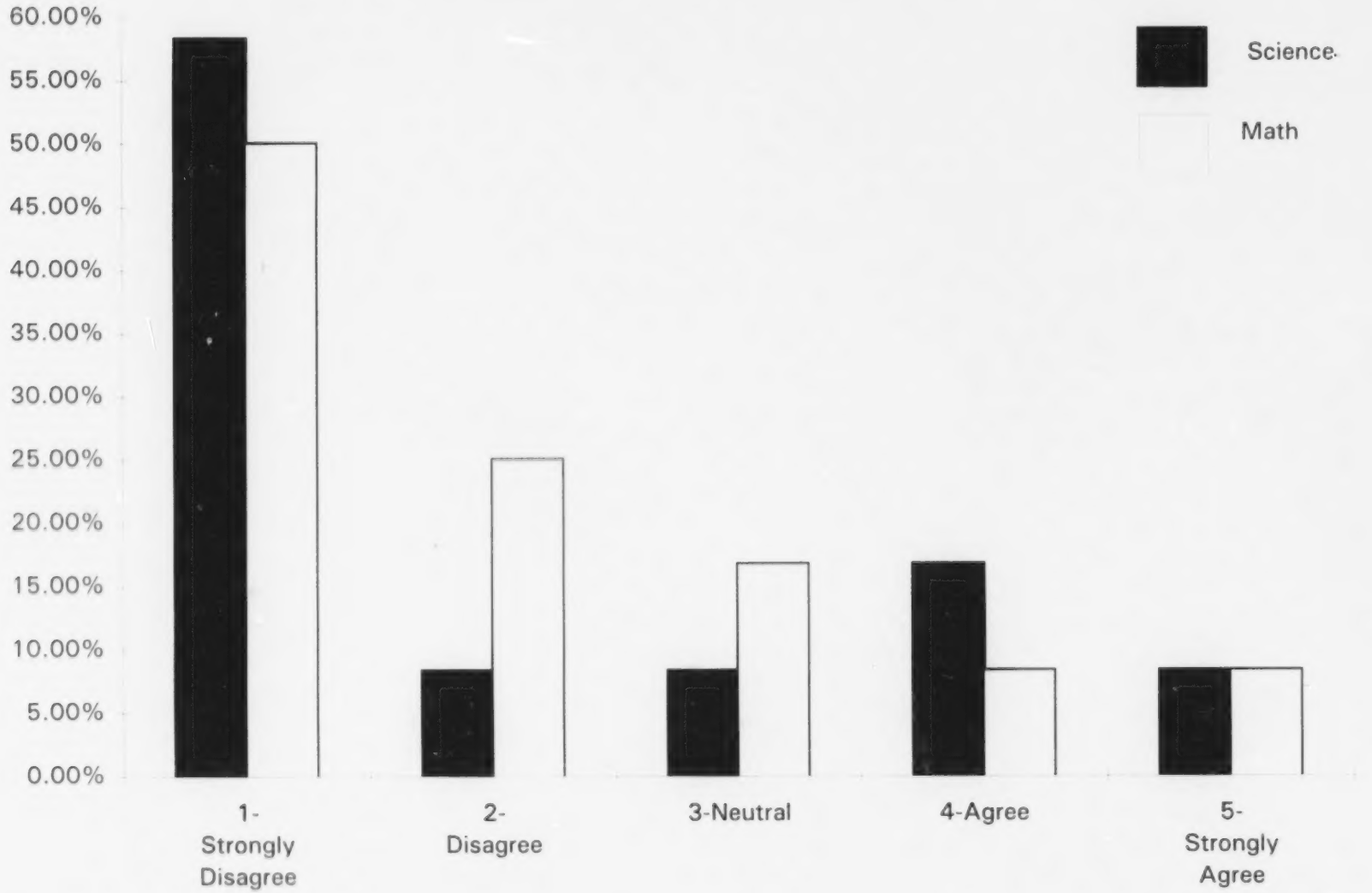
Science
Math
1- Strongly Disagree
2- Disagree
3-Neutral
4-Agree
5- Strongly Agree

Figure Caption

Figure 9. Upper grade teachers' ratings on their levels of computer integration with science and math lessons.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Science
Math
1- Strongly Disagree
2- Disagree
3-Neutral
4-Agree
5- Strongly Agree

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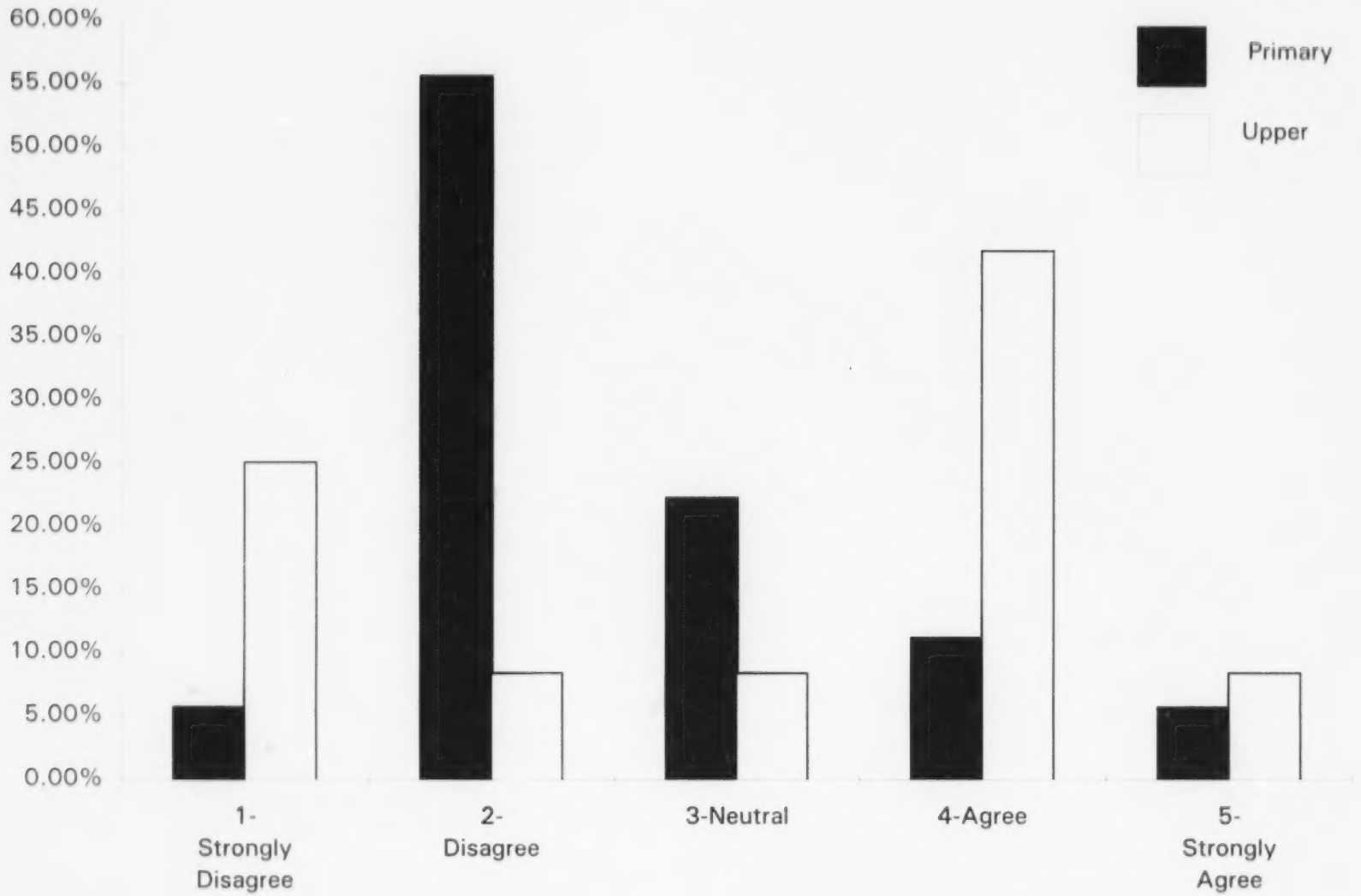
Figure Caption

Figure 10. Comparison of primary and upper grade teachers stated levels of computer integration with social studies lessons.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Primary
Upper
1- Strongly Disagree
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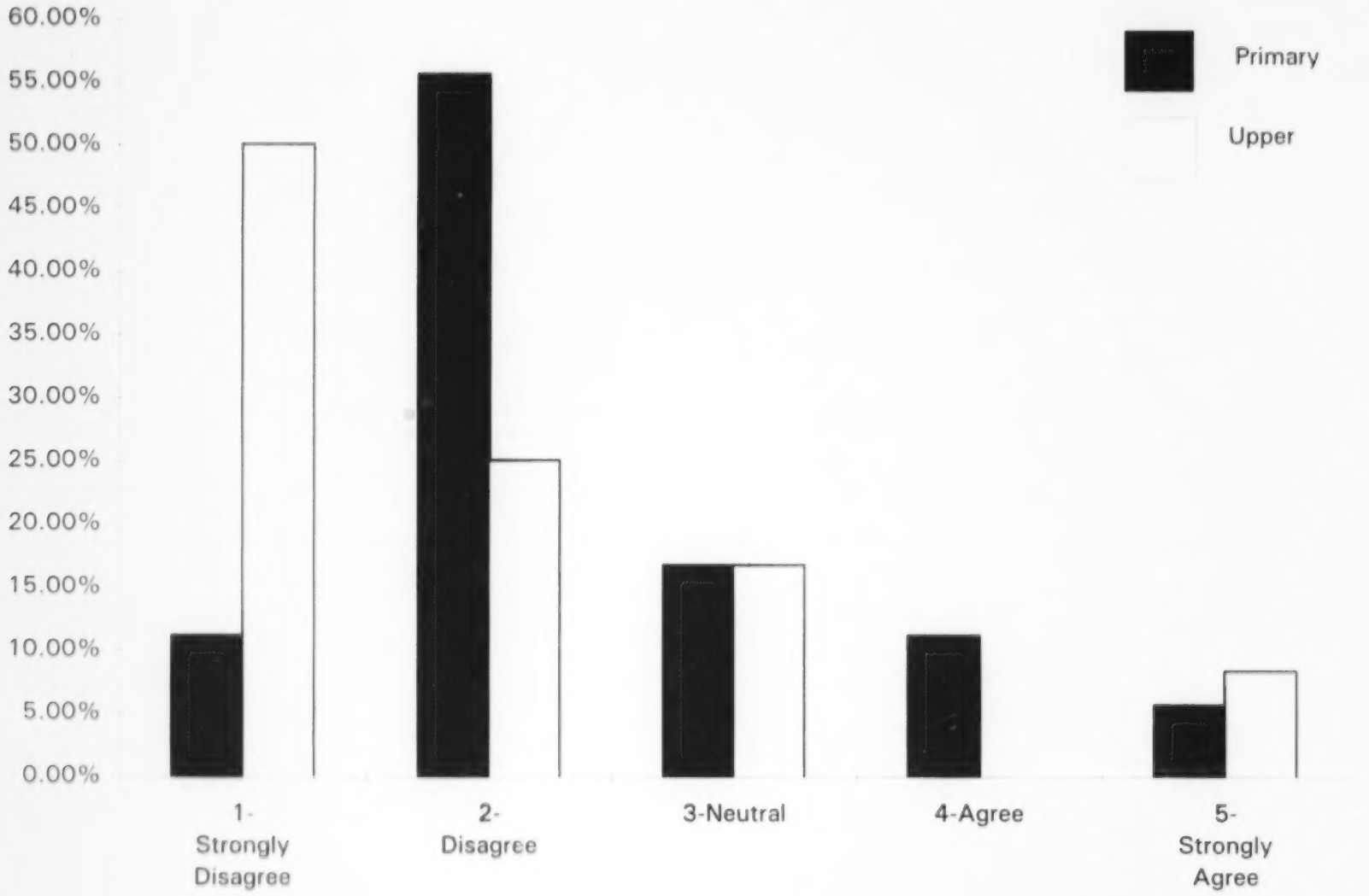
3-Neutral
4-Agree
5- Strongly Agree

Figure Caption

Figure 11. Comparison of primary and upper grade teachers stated levels of computer integration with health lessons.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Primary
Upper
1- Strongly Disagree
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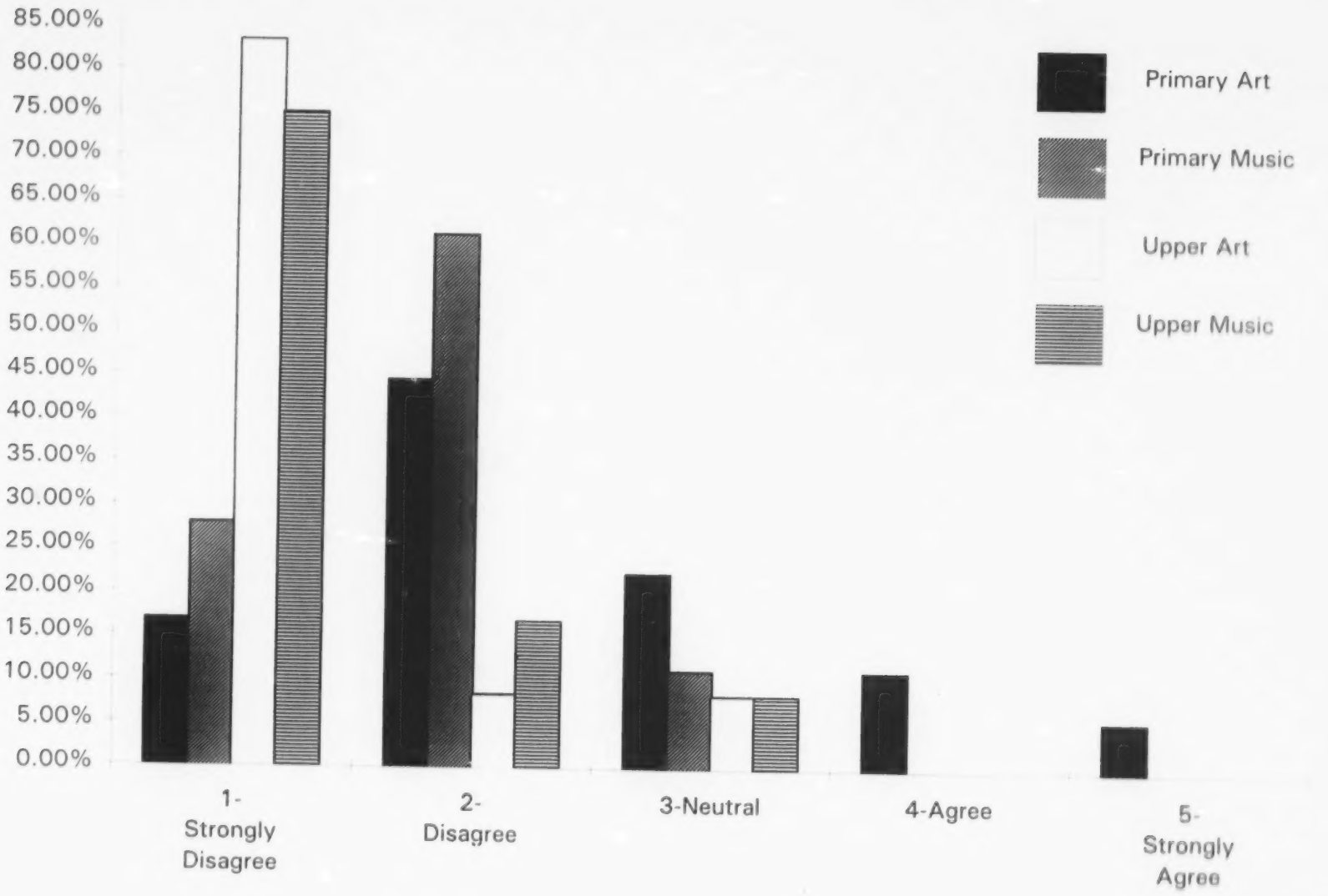
5- Strongly Agree

Figure Caption

Figure 12. Reported levels of computer integration with music and art lessons by primary and upper grade teachers..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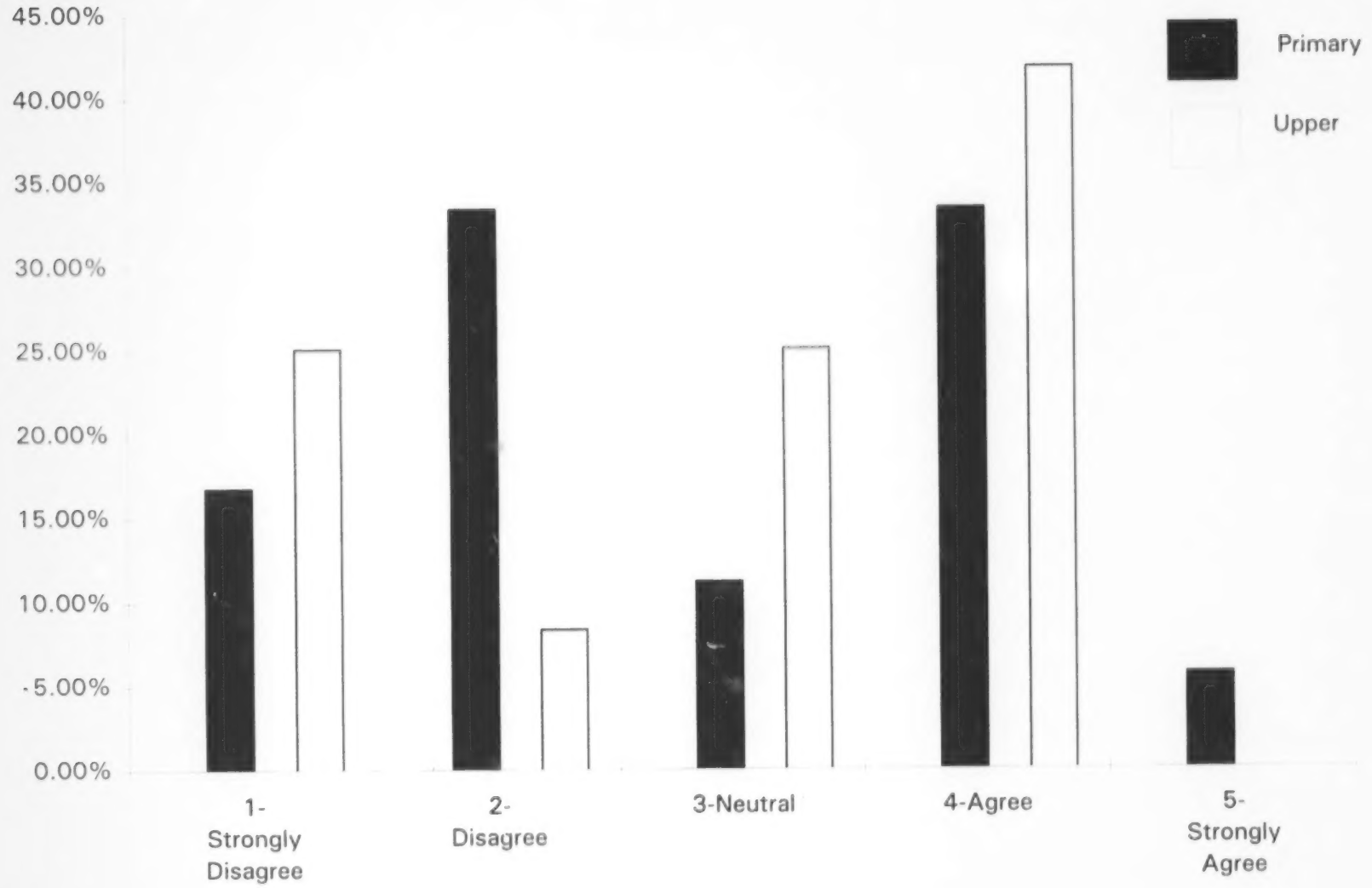
Primary Art
Primary Music
Upper Art
Upper Music
1- Strongly Disagree
2- Disagree
3-Neutral
4-Agree
5- Strongly Agree

Figure Caption

Figure 13. Comparison of primary and upper grade teachers stated computer lab preparation time in relevance to their regular classroom preparation time.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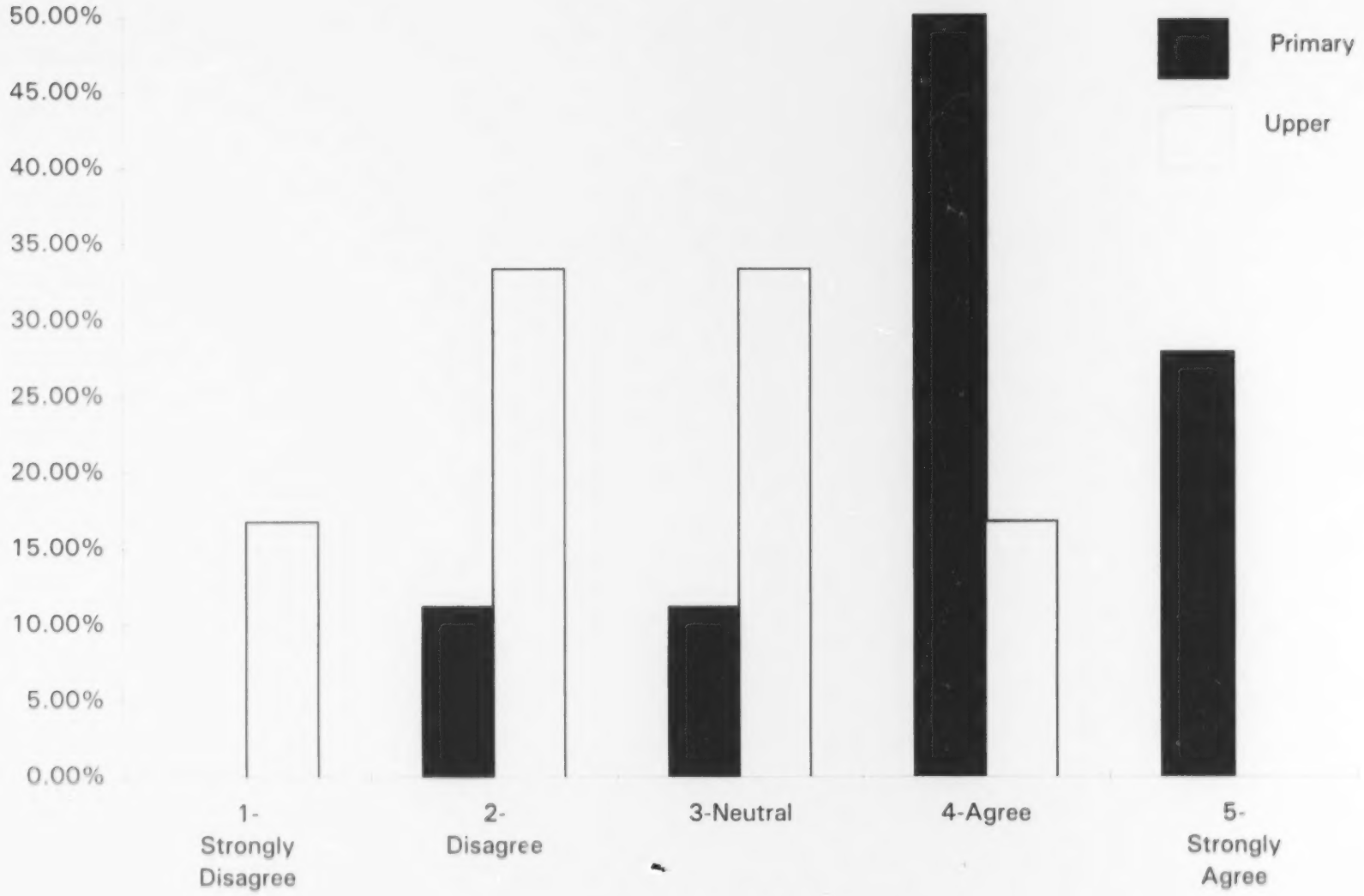
Primary
Upper
1- Strongly Disagree
2- Disagree
3-Neutral
4-Agree
5- Strongly Agree

Figure Caption

Figure 14. Primary and upper grade teachers responses to whether they use the computer lab on a weekly basis.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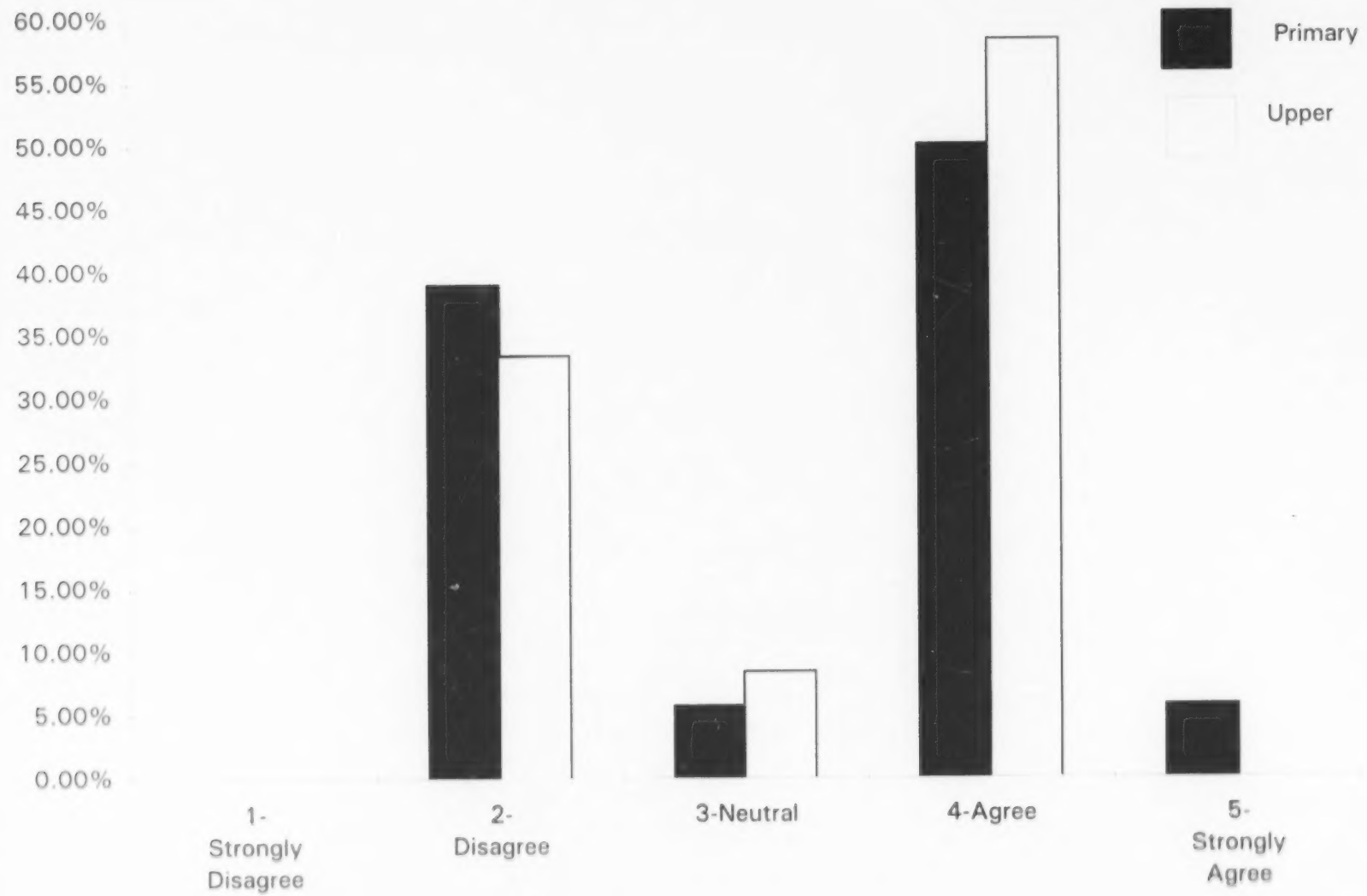
Primary
Upper
1- Strongly Disagree
2- Disagree
3-Neutral
4-Agree
5- Strongly Agree

Figure Caption

Figure 15. Primary and upper grade teachers responses to whether their school has effective in-services.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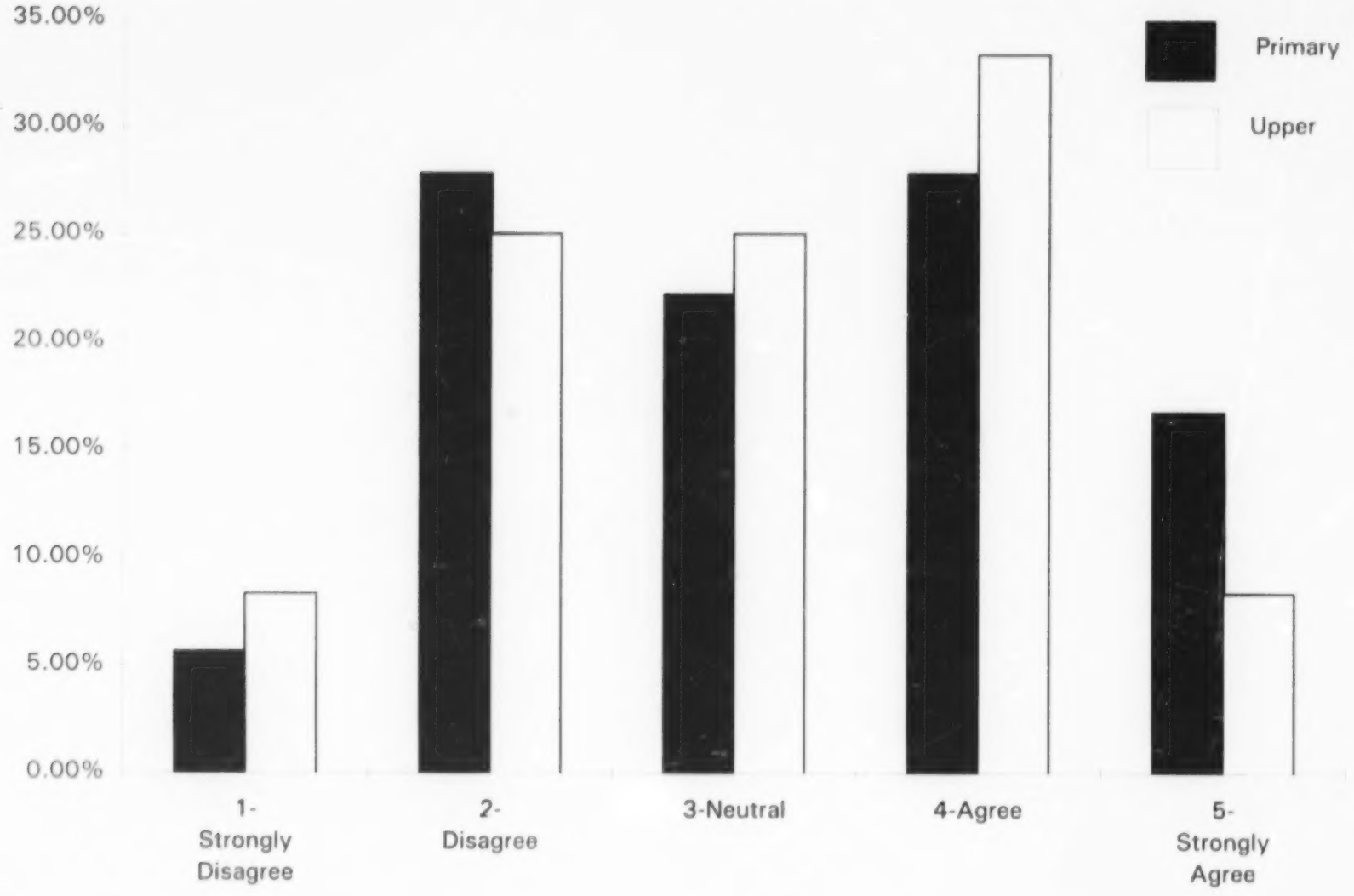
Primary
Upper
1- Strongly Disagree
2- Disagree
3-Neutral
4-Agree
5- Strongly Agree

Figure Caption

Figure 16. Primary and upper grade teachers answers to whether the only reason they teach the computer is because of the technology Standards of Learning.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Primary
Upper
1- Strongly Disagree
2- Disagree
3-Neutral
4-Agree
5- Strongly Agree